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<p><b>(21) International Application Number:</b> PCT/US96/18688</p> <p><b>(22) International Filing Date:</b> 18 November 1996 (18.11.96)</p> <p><b>(30) Priority Data:</b></p> <table border="0"> <tr> <td>08/544,434</td> <td>17 November 1995 (17.11.95)</td> <td>US</td> </tr> <tr> <td>08/616,731</td> <td>15 March 1996 (15.03.96)</td> <td>US</td> </tr> </table> <p><b>(71) Applicant:</b> THE DIAL CORPORATION [US/US]; 1850 North Central Avenue, Phoenix, AZ 85077 (US).</p> <p><b>(72) Inventors:</b> PARTEE, Terrell, L.; 15816 North 62nd Place, Scottsdale, AZ 85254 (US); VARKER, Charles; 1806 East Redfield Road, Phoenix, AZ 85022 (US); MORSE, Elaine, T.; 1356 South 30th Street, Mesa, AZ 85204 (US); MORGAN, Ronald, D.; 508 South Catalina Street, Gilbert, AZ 85234 (US).</p> <p><b>(74) Agent:</b> HAUFF, Charles, F., Jr.; Snell &amp; Wilmer L.L.P., One Arizona Center, Phoenix, AZ 85004-0001 (US).</p>		08/544,434	17 November 1995 (17.11.95)	US	08/616,731	15 March 1996 (15.03.96)	US	<p><b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b>  <i>With international search report.        Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
08/544,434	17 November 1995 (17.11.95)	US						
08/616,731	15 March 1996 (15.03.96)	US						
<p><b>(54) Title:</b> DETERGENT HAVING IMPROVED PROPERTIES</p> <p><b>(57) Abstract</b></p> <p>In accordance with various aspects of the present invention, a laundry detergent comprises an agglomerated admixture of a base granular formulation and a detergent agglomerate. Preferably, the base granular composition comprises a carrier together with a copolymer. Preferably, the copolymer comprises an alkali metal salt of a polyacrylic acid, polymethacrylic acid or copolymer of acrylic and methacrylic acids, and evidences a molecular weight preferably in the range of about 2,000 to about 5,000 and more preferably in the range of about 2,000 to about 4,000.</p>								

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## DETERGENT HAVING IMPROVED PROPERTIES

### Technical Field.

- 5           The present invention relates, generally, to laundry detergents, and more particularly, to laundry detergents having improved properties.

### Background of the Present Invention.

- Laundry detergents are, of course, well known. As is also well known, in use, such detergents often leave a residue on the items  
10   washed in water containing the detergent. In the case of clothing items, this encrustation can result in a loss of softness of the article and the corresponding loss of comfort for the user.

- In addition, and as is also well known, the dirty wash liquor and mineral encrustation can, unless inhibited, redeposit on the clothes  
15   tending to create unsightly films. After several washes, particularly in the case of colored clothing items, such redeposition can result in fading or other loss of color in such clothing items.

- While many attempts have been made to improve laundry detergent anti-encrustation and anti-redeposition properties, none have  
20   satisfactorily accomplished that objective, particularly in the context of general carbonate-built heavy-duty laundry detergents. The present invention addresses this long felt, yet unresolved need.

### Summary of the Invention.

- In accordance with various aspects of the present invention, a  
25   laundry detergent comprises an agglomerated admixture of a base granular formulation and a detergent agglomerate. Preferably, the base granular composition comprises a carrier together with a copolymer. In

accordance with a further aspect of the present invention, preferably, the base granular composition is spray-dried in a conventional fashion and then admixed with a detergent agglomerate.

Preferably, the copolymer comprises an alkali metal salt of a  
5 polyacrylic acid, polymethacrylic acid or copolymer of acrylic and methacrylic acids, and evidences a molecular weight preferably in the range of about 2,000 to about 5,000 and more preferably in the range of about 2,000 to about 4,000.

In accordance with an alternative embodiment of the present  
10 invention, the detergent includes a chlorine scavenger. The addition of such a composition has been found to exhibit surprising improvements in the color retention of garments which are washed with detergents according to the present invention, which improvements are believed to result from improved anti-encrustation, anti-redeposition and chlorine  
15 scavenging properties of the detergent. Preferably, the chlorine scavenger comprises a reducing agent, such as sodium perborate, sodium percarbonate and/or the like.

#### **Detailed Description of Preferred Exemplary Embodiments.**

Preferred exemplary embodiments of the present invention will  
20 hereafter be described in conjunction with the description that follows. It will be understood that the detail provided herein is for illustration purposes only and that the subject invention is not so limited.

While the specific formulations of detergent within the present invention will be described in greater detail hereinbelow, in general, a  
25 detergent formulation in accordance with the present invention comprises a base detergent including an alkali metal carbonate and a copolymer, and an agglomerated admix. Preferably, the base detergent

and copolymer are spray dried, in a conventional fashion, and thereafter admixed in a blending formulation including the detergent agglomerate.

- In accordance with a preferred aspect of the present invention, the base granular composition is formed in a slurry which is spray-dried, and thereafter dry blended with the agglomerate, colorant, etc. to arrive at the final dry, particulate detergent. Preferably, a slurry comprising the base detergent ingredients is spray-dried and admixed with the agglomerate in a blending formulation which may also include anti-cake agents, whitening agents (e.g. fluorescent whitening agents), bleaching agents, alkalinity agents (e.g. alkali metal silicates), perfumes and/or colorants. Optional additional ingredients, such as foam control agents, processing aids, stain removal agents and other performance agents may also be utilized either in the blending formulation, the base detergent formulation or agglomerate as desired.
- Preferably, the base detergent formulation comprises an alkali metal carbonate builder, an anionic surfactant, an inert diluent and a copolymer. Preferably, the builder (e.g. the alkali metal carbonate) is present in the base bead formulation in an amount from about 30 to about 50 wt% and more preferably from about 34 to about 41 wt%.
- Suitably, the alkali metal carbonate comprises sodium carbonate. Preferably, the anionic surfactant is present in the base bead formulation in an amount from about 6 to about 15 wt% and more preferably from about 6.25 to about 14.8 wt%. Suitable anionic surfactants include alkyl, alkylaryl or alkenyl sulfonates and alkyl and alkylene ethoxysulfates. Sodium dodecylbenzenesulfonate or tridecylbenzenesulfonate are particularly preferred anionic surfactants. Preferably, the inert diluent is present in the base bead formulation in an amount from about 35 to about 45 wt% and more preferably from about

37.69 to about 43.18 wt%. Suitable inert diluents comprise alkali metal chlorides, sulfates, nitrates and/or the like. For example, a preferred diluent comprises sodium chloride, sodium sulfate and/or mixtures thereof.

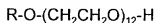
- 5        The base detergent also includes a copolymer, preferably having a molecular weight in the range of about 2,000 to about 5,000, more preferably between about 2,000 and about 4,000 or between about 2,000 and about 3,000. Preferably, the copolymer is present in an amount of up to about 5 wt%, more preferably from about 0.59 to about
- 10    1.20 or 1.25 wt%. Preferably, the copolymer is comprised of an alkali metal salt of polyacrylic acid, polymethacrylic acid or a copolymer of acrylic and methacrylic acids, having a molecular weight in the range of about 2,000 to about 5,000, preferably about 2,000 to about 4,500, and more particularly about 2,000 to about 3,000. Preferably the
- 15    polyacrylate has a pH in the range of about 5.0 to about 9.0, and more preferably about 5.0 to about 7.0. One particularly preferred polyacrylate comprises Polymer X-0125-BJ-76 available from Rhone-Poulenc of Cranbury, New Jersey. All or a portion of the polymeric additive (*i.e.* the aforementioned copolymer) may also be contained in
- 20    the agglomerate or blending formulation. In such cases, the copolymer may be present in amounts similar to those discussed hereinabove, for example, on the order of up to about 5.0 wt%, preferably in an amount from about 0.59 to 1.25 wt%.

- 25        The base detergent may include other conventional additives such as whitening agents, bleach and/or bleach alternatives, anti-caking agents and/or other similar adjuvants. Each of these adjuvants may be added in conventional amounts. For example, stilbene whitening agents are suitable for use within the context of the present invention. Such

- agents include the cyanuric chloride/diaminostilbene disulfonic acid (CC/DAS) type whiteners. For example, preferable whitening agents comprise TINOPAL® AMS-GX, available from CIBA-GEIGY Corporation of Greensboro, North Carolina, Blancophor DML SV2447 available from
- 5 Mobay Chemical Corp. of Pittsburgh, Pennsylvania and/or mixtures thereof.

- Preferably, the agglomerated admix comprises a nonionic surfactant and a builder. Suitable nonionic surfactants include primary and secondary ethoxylated alcohols and the like. Preferably, such
- 10 ethoxylates have about 2 to about 15 moles of ethylene oxide per mole of alcohol. Suitably the builder comprises an alkali metal carbonate, for example, sodium carbonate. Optional additives such as anti-caking agents and the like may also be incorporated into the admix in conventional amounts.

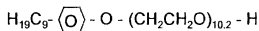
- 15 In accordance with a preferred aspect of the present invention, the detergent agglomerate includes nonionic surfactants comprising a primary or secondary alcohol ethoxylate, such as a linear alcohol ethoxylate having a molecular weight in the range of 650 to 750, more preferably in the range of about 668 to about 703 and an EO content
- 20 (weight percent) in the range of about 65 to about 75. Particularly preferred ethoxylates of this type include those of the general formula:



- Where R is a blend of primary (linear) alcohols having between 12 and 16 carbons, preferably about 66% C<sub>12</sub>, 27% C<sub>14</sub> and 6% C<sub>12</sub> alcohols.
- 25 One such commercially available ethoxylate of this formula comprises SURFONIC® L24-12 surfactant available from Huntsman Corporation of

Houston, Texas having a molecular weight of about 703 and an EO content (wt%) of about 71.9. (SURFONIC is a registered trademark of the Huntsman Corporation.) Other preferred ethoxylates include those of the general formula:

5



For example, ethoxylates generally referred to under the generic name Nonoxynol-10 typically fall within this category. A particularly preferred  
 10 ethoxylate of this formula comprises SURFONIC® N-102 Surfactant also available from Huntsman Corporation of Houston, Texas having a molecular weight of about 668 and an EO content (wt%) of about 67.1.

Preferably, the agglomerate also comprises anti-caking agents and builders. A preferable anticake agent comprises sodium silicate and  
 15 a preferable builder comprises sodium carbonate. A particularly preferred detergent agglomerate includes between about 65 and about 85wt%, preferably about 75wt% sodium carbonate, and between 13 and about 18wt%, preferably about 15wt% nonionic which evidences a bulk density of between about 730 and about 830 g/l.

20 In accordance with one aspect of the present invention, the detergent composition may optionally include a colorant composition. For example, the colorant composition may comprise a pink colorant composition having the following components, all listed in weight percent:

25	Primary alcohol ethoxylate	87.50
	Red pigment	5.00
	TiO <sub>2</sub>	7.50

The primary alcohol ethoxylate may be of the form previously discussed hereinabove or any other suitable ethoxylate. It should be appreciated



that other colorants may also be used, if desired, in the context of the present invention. In accordance with various aspects of the present invention the base bead composition, the agglomerated admix and the colorant composition, if any, are blended together in a blending formula  
5 which preferably also includes anti-cake agents, bleaching agents and perfumes.

In general, the blending formulation comprises about 50 to about 95 wt% of the base detergent and about 5 to about 45 wt% of the agglomerated admix, the remainder comprising conventional detergent  
10 additives. For example, the blending formulation may comprise about 50 to about 65 wt%, more preferably about 52 to about 57 wt%, and optimally about 55 wt% of the base detergent granular, and preferably about 25 to about 45 wt%, more preferably about 30 to about 40 wt%, and optimally about 33 wt% of the detergent agglomerate. In  
15 accordance with another aspect of the present invention, the blending formulation preferably comprises about 65 to about 95 wt%, more preferably about 75 to about 90 wt%, and optimally about 89 wt% of the base detergent granular, and preferably about 5 to about 25 wt%, more preferably 7 to about 15 wt% and optimally about 9 wt% of the detergent  
20 agglomerate.

In accordance with certain aspects of further alternative embodiments of the present invention the detergent formulation may also include an effective amount of a chlorine scavenger, preferably added to the blending formulation. It should be appreciated, however,  
25 that such additive may be included instead in the base bead formulation, the admix composition or both. Preferably, the scavenging additive comprises sodium percarbonate, sodium perborate or mixtures thereof. Other chlorine scavenging agents, such as sodium thiosulfate and the

like may also be employed. Suitably, such additive is present in an amount which is effective to scavenge a predetermined amount of chlorine which may be present in the wash liquor, say for example on the order of about 0.5 to about 2.0 ppm. Preferably, such additive is

5 present in an amount at least as great as the copolymer. For example, such a scavenger may be present in the blending formulation in an amount of about 0.59 to about 1.20 or 1.25 wt%. However, in certain applications, the amount may be increased such that in addition to serving a chlorine scavenging role, the reducing agent alone or in

10 combination with other compositions may perform as a bleaching agent. In such cases, the agent may be present in an amount on the order of 6.25 wt% or more.

Preferred blending formulations in accordance with various aspects of this embodiment of the present invention, with each of the

15 components set forth in weight percent, are as follows:

	<u>Formulation 1</u>	<u>Formulation 2</u>	<u>Formulation 3</u>	<u>Formulation 4</u>	<u>Formulation 5</u>
Base bead	55.16	88.61	96.44	85.14	97.42
Agglomerated admix	33.33	9.13	2.60	7.38	1.38
Colorant composition	0.11	0.00	0.00	0.24	0.24
Sodium percarbonate	10.50	0.00	0.00	0.00	0.59
20 Sodium perborate	0.00	1.25	0.59	6.25	0.00
Inorganic filler	0.90	0.50	0.00	0.50	0.50
Perfume	0.24	0.26	0.12	0	0.12

Preferably, the detergents in accordance with the present invention comprise low to moderate density, general, heavy-duty

25 laundry detergent powders. In accordance with a preferred aspect of the present invention, the pore density of the finished product is preferably less than about 900 g/l, more preferably in the range of about 400 g/l. The detergents in accordance with the present invention have been found to be particularly well-suited for a broad range of

applications, for example, ranging from gentle cleaning powder detergents to general heavy-duty laundry powder detergents.

- Preferred final compositions (*e.g.* corresponding to Formulations 1 -5 in accordance with the present invention include the following components, all of which are listed in weight percent:

		Formulation 1	Formulation 2	Formulation 3	Formulation 4	Formulation 5
10	Sodium chloride	25.45	38.25	38.87	36.69	36.72
	Sodium carbonate	4.47	30.65	38.49	29.45	39.66
	Sodium carbonate <sup>1</sup>	25.00	6.85	2.21	5.54	1.04
	Sodium silicate	3.04	3.99	0.51	3.83	12.66
	Sodium silicate <sup>1</sup>	2.33	0.64	0.00	0.52	0.10
	Sodium dodecylbenzenesulfonate/ tridecylbenzenesulfonate	18.00	13.20	6.00	12.68	6.00
15	Primary alcohol ethoxylate <sup>1</sup>	5.00	1.37	0.39	1.11	0.18
	Sodium polyacrylate	2.00	1.25	0.59	1.20	0.59
	Fluorescent whitening agent	0.70	0.26	0.11	0.25	0.25
20	Sodium sulfate <sup>2</sup>	0.70	0.12	0.81	0.18	0.12
	Water	1.56	1.16	0.96	1.07	1.01
	Perfume	0.24	0.26	0.12	0.24	0.12
	Sodium percarbonate	10.50	0.00	0.00	0.00	1.25
	Sodium perborate	0.00	1.25	0.59	6.25	0.00
25	Colorant composition	0.11	0.25	0.00	0.24	0.00
	Synthetic magnesium silicate	0.90	0.50	0.00	0.50	0.50

<sup>1</sup> from the agglomerate

<sup>2</sup> from the slurry

- It should be appreciated that while Formulations 1 to 5 are set forth in an illustrative manner herein, other detergent formulations having similar compositions or compositions generally between those of Formulations 1 to 5 are within the scope of the present invention.

For example, it should be appreciated that detergents in accordance with the present invention may include traditional heavy duty detergents, ultra (*i.e.* concentrated) detergents, or either with

bleach or bleach alternatives. In this regard Formulations A to C also exemplify various aspects of the present invention, with all amounts listed as weight percents.

	A	B	C
Builder	40.70	34.94	37.50
5 Inert Diluent	36.72	35.05	36.72
Anticake agent	12.76	6.51	6.88
Anionic Surfactant	6.00	12.70	13.20
Nonionic Surfactant	0.64	1.52	1.52
10 Copolymer	0.59	1.20	1.25
Chlorine Scavenger	0.59	6.25*	1.25
Bleach Alternative	0.72	0.25*	0.26

15 \* In this example B, the bleaching function of the formulation is effected, in part, by the scavenger.

In accordance with various aspects of the present invention, and as described hereinabove, the detergent compositions according to the present invention preferably incorporate a polymeric component which aids in preventing redeposition of the dirty wash liquor on the items washed/cleaned with the detergent. Moreover, the detergent compositions also include an effective amount of a chlorine scavenger. The present inventors have found that detergents made in accordance with the present invention evidence improvements in inhibiting encrustation, redeposition and chlorine discoloration over repeated use.

25 Stated another way, the detergents of the present invention enable good cleaning while significantly reducing the deposition of minerals and/or soil to maintain fabric softness and appearance.

To evidence the improved performance characteristics of the detergents according to the present invention, tests have been conducted to determine the presence of residues left on clothes washed

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with the detergents of the present invention, the softness of such articles after washing and the effect of such detergents on color retention of the articles washed. The following Examples reflect such tests.

#### Example 1 - Lack of Residues

5            Similarly sized, colored (navy blue) and content (100% cotton knit) pieces of fabric were washed in a conventional Tergotometer over five (5) cycles. In one case a wash liquor containing an amount of a conventional non-built, mixed active detergent without copolymer addition was used; in the other case an equal amount of a detergent of  
10           the composition set forth hereinabove in Formulation 1 was used. After washing over the five (5) cycles, the fabric samples were evaluated by a multi-member panel for residue on a scale of 0 to 5, with 0 being reflective of no residue, 1 being reflective of slight residue, 2 being reflective of low residue, 3 being reflective of moderate residue, 4 being  
15           reflective of heavy residue and 5 being reflective of very heavy residue. The samples were evaluated and the scores averaged. The samples washed with the conventional detergent were evaluated as exhibiting a heavy to very heavy residue (4.50) whereas the samples washed in a detergent in the form of Formulation 1 exhibited only low to moderate  
20           residue (2.50).

#### Example 2 - Enhanced Softness

             The fabric samples used in Example 1 were also evaluated by the panel for softness by comparing the respective washed samples to unwashed fabric samples (*i.e.* a control) and evaluating them on a  
25           softness scale of 1 to 5 with 1 indicating that the test sample was much softer than the control, 2 indicating the test sample was slightly softer

than the control, 3 indicating the test sample was equally as soft as the control, 4 indicating the test sample was slightly rougher than the control, and 5 indicating the test sample was much rougher than the control. The samples washed in the conventional detergent were  
5 evaluated as being slightly to much rougher than the control (4.20), whereas the samples washed in the detergent according to the present invention having a composition of that set forth above in Formulation 1 were about as soft as the control or slightly rougher (3.70).

#### Example 3 - Improved Color Retention

10 The fabric samples used in Example 1 were also evaluated by the panel for color retention. The panel compared the respective washed samples against a control unwashed fabric sample. As is generally known encrustation tends to make dark fabrics appear lighter due to the mineral build-up on the fabric, and thus the samples were evaluated on  
15 a darkness scale of 1 to 5, with 1 indicating that the sample was much darker than the control, 2 indicating slightly darker than the control, 3 indicating the same color as the control, 4 indicating slightly lighter than the control, and 5 indicating much lighter than the control. The samples washed in the conventional detergent were evaluated by the panel as  
20 being generally slightly lighter than the control (3.80), whereas the samples washed in the detergent according to the invention were generally about the same color as the control (3.10), thus evidencing superior color retention.

#### Example 4 - Improved Color Retention

25 Similarly sized, colored and content (100% cotton and 50/50 polyester/cotton blend fabrics) pieces of fabric were washed in a

- conventional washing machine over ten (10) wash cycles in a conventional non-built, mixed active detergent and a formulation of the composition set forth above as Formulation 2; after washing the samples were compiled into sets. Each set contained a test fabric
- 5 washed in the inventive detergent, a test fabric washed in the conventional detergent and an unwashed fabric sample. These sets were evaluated by a multi-member panel, with each member comparing each of the two test fabrics to the unwashed (control) sample. The samples were rated on a scale of 1 to 10, with 1 being not similar to the
- 10 control and 10 being identical to the control. Additionally, each panelist was asked to choose the test fabric visually most similar to the control.

The panel ratings were averaged and the results are as follows:

TABLE 1

	Green <sup>1</sup>	Blue <sup>1</sup>	Black <sup>1</sup>	Red <sup>2</sup>	Blue <sup>2</sup>	Green <sup>2</sup>
Formulation 2 (avg)	7.84	7.63	8.69	8.66	8.56	8.6
15 Conventional (avg)	2.58	3.5	4.03	7.6	5.69	4.0

<sup>1</sup> - 100% cotton

<sup>2</sup> - 50/50 poly-cotton blend

- As is shown in Table 1, all of the test swatches for all of the colors and fabric types washed with the detergent Formulation 2 in accordance
- 20 with the present invention were rated by the panelists as significantly more similar to the control (*i.e.* unwashed sample) than the swatches washed with the conventional detergent.

Example 5 - Improved Color Retention

The test of Example 4 was repeated using a detergent having the composition set forth above as Formulation 4 instead of Formulation 2.

These samples were compared with the unwashed swatches and

- 5 swatches washed under similar conditions with conventional detergents.

Again, all of the test swatches for all of the colors and fabric types

washed with detergent in accordance with the present invention (e.g.

Formulation 4) were rated by the panelists as significantly more similar in color to the control (e.g. unwashed sample) than the swatches

- 10 washed with the conventional detergent.

Further, the panel rated the samples as follows:

TABLE 2

	Burgundy <sup>1</sup>	Blue <sup>1</sup>	Green <sup>1</sup>	Burgundy <sup>2</sup>	Green <sup>2</sup>	Brown <sup>2</sup>
Formulation 4 (avg)	7.75	7.28	8.21	8.78	7.50	8.84
Conventional (avg)	4.56	4.31	4.63	7.16	4.41	6.56

- 15 <sup>1</sup> - 100% cotton

<sup>2</sup> - 50/50 poly-cotton blend

Example 6 - Improved Color Retention

Fabric samples of various colors of 100% cotton and 50/50 poly-cotton blend materials were washed in over 20 wash cycles with, on one

- 20 hand, detergent of the formulations set forth herein (namely

Formulations 2 and 4) and on the other hand, a control conventional non-built, mixed active detergent. Colormetric readings from a color view spectrophotometer were taken at 0, 10, 15 and 20 cycles in conformance with ASTM D2244, E308 and 2244.



The data obtained was evaluated to determine the Total Color Difference namely  $\Delta E$ , where

$$\Delta E = \sqrt{(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2}$$

- 5 and L, a and b refer to the widely accepted tristimulus L, a, b scale coordinates, where L approximates the non-linear black-white response, and a and b identify the hue and chroma of the material on red-green and yellow-blue scales respectively. In accordance with such evaluations a high  $\Delta E$  is reflective of high (*i.e.* significant) color change.

- 10 The results of these tests are illustrated in Tables 3-6 below:

TABLE 3

	Control Wash/Dry Cycles			Formulation 2 Wash/Dry Cycles		
	10 $\Delta E$	15 $\Delta E$	20 $\Delta E$	10 $\Delta E$	15 $\Delta E$	20 $\Delta E$
Fabric 100% Cotton						
Black A	1.89	4.12	6.30	0.63	0.94	1.59
Black B	0.97	3.17	5.04	0.61	1.09	1.71
Green A	5.11	7.95	9.77	1.01	2.15	3.05
Green B	4.28	7.16	9.05	1.13	2.09	2.55
Blue A	3.87	6.00	8.46	0.79	1.34	2.43
Blue B	3.79	6.78	8.41	0.47	1.38	2.01

TABLE 4

		Control Wash/Dry Cycles			Formulation 2 Wash/Dry Cycles		
		10 $\Delta E$	15 $\Delta E$	20 $\Delta E$	10 $\Delta E$	15 $\Delta E$	20 $\Delta E$
5	Fabric 50/50 poly/cotton						
	Royal Blue	1.44	1.96	2.82	0.79	1.06	1.47
	Brown	1.32	2.55	3.41	0.67	0.84	1.60
	Burgundy	1.75	2.72	3.19	0.92	1.43	1.98

TABLE 5

		Control Wash/Dry Cycles			Formulation 4 Wash/Dry Cycles		
		10 $\Delta E$	15 $\Delta E$	20 $\Delta E$	10 $\Delta E$	15 $\Delta E$	20 $\Delta E$
10	Fabric 50/50 poly/cotton						
	Brown A	1.00	2.10	2.98	0.43	0.58	1.33
	Brown B	1.20	2.00	2.88	0.43	1.00	1.55
15	Green A	1.36	3.74	5.56	0.46	0.98	2.33
	Green B	1.70	3.73	5.74	0.39	0.86	2.17
	Maroon A	0.93	1.56	2.37	0.39	0.60	1.15
	Maroon B	0.59	1.45	2.39	0.61	0.62	1.38

TABLE 6

		Control Wash/Dry Cycles			Formulation 4 Wash/Dry Cycles		
		10 $\Delta E$	15 $\Delta E$	20 $\Delta E$	10 $\Delta E$	15 $\Delta E$	20 $\Delta E$
20	Fabric 100% Cotton						
	Black A	1.98	3.55	5.34	0.68	1.13	2.76
	Black B	1.66	3.23	4.85	0.65	1.32	2.54
	Blue A	1.88	3.52	5.25	0.27	1.02	2.64
	Blue B	1.40	3.23	5.44	0.20	1.29	3.01
25	Green A	2.25	3.90	4.62	0.97	1.39	2.58
	Green B	2.18	3.80	5.06	0.85	1.33	2.38
	Maroon A	1.82	3.09	4.53	1.62	1.81	2.87
	Maroon B	2.02	3.50	4.76	1.14	1.69	2.95

As should now be appreciated, the detergents in accordance with the present invention evidence improved color retention and other properties. Such detergents are particularly suited for use in a wide variety of cleaning applications.

- 5           It will be understood that the foregoing description is of preferred exemplary embodiments of the present invention, and that the present invention is not limited to the specific examples and compositions set forth herein. Such examples and compositions are for illustrative purposes only. Various modifications may be made in light thereof as
- 10 will be suggested to persons skilled in the art without departing from the scope of the invention as expressed in the appended claims.

**WE CLAIM:**

- 1            1.    A low density laundry detergent composition having  
2 improved anti-redeposition properties comprising:  
3            about 50 to about 95 wt% of a spray dried slurry of a base  
4 detergent composition including a sodium polyacrylate having a  
5 molecular weight in the range of about 2,000 to about 5,000; and,  
6            about 5 to about 45 wt% of an agglomerated admix formulation  
7 including nonionic surfactant; and,  
8            about 0 to about 5 wt% of an additive.
  
2.    The laundry detergent composition of claim 1 wherein the sodium polyacrylate comprises about 1 to about 5 wt% of the laundry detergent composition, and wherein the sodium polyacrylate is a sodium salt of polyacrylic acid, polymethacrylic acid or a copolymer thereof.
  
3.    The laundry detergent composition of claim 2 wherein the sodium polyacrylate is present in an amount of about 0.59 to about 3.62 wt.% of the laundry detergent composition.
  
4.    The laundry detergent composition of claim 3 wherein the sodium polyacrylate has a molecular weight in the range of 2000 to 4500.
  
5.    The laundry detergent composition of claim 3 wherein the sodium polyacrylate comprises Polymer X-0125-BJ-76.
  
6.    The laundry detergent composition of claim 1 wherein the base detergent composition includes an alkali metal carbonate.

7. The laundry detergent composition of claim 6 wherein the alkali metal carbonate is sodium carbonate, and wherein the base detergent composition further includes an anionic surfactant and an inert diluent.

8. The laundry detergent composition of claim 7 wherein the anionic surfactant is an alkyl sulfonate, an alkylaryl sulfonate, an alkenyl sulfonate, an alkyl ethoxysulfate or an alkylene ethoxysulfate.

9. The laundry detergent composition of claim 8 wherein the anionic surfactant is the alkyl sulfonate comprising about 8-35 wt% of the laundry detergent composition.

10. The laundry detergent composition of claim 9 wherein the alkyl sulfonate is dodecylbenzenesulfonate.

11. The laundry detergent composition of claim 7 wherein the inert diluent includes sodium chloride, sodium sulfate, or a mixture thereof.

12. The laundry detergent composition of claim 1 wherein the nonionic surfactant includes primary or secondary ethoxylated alcohols having about 2-15 moles of ethylene oxide per mole of alcohol.

13. The laundry detergent composition of claim 1 wherein the nonionic surfactant is a linear alcohol ethoxylate having a molecular weight of about 650-750.

1           14. A method of preparing a low density laundry detergent  
2 composition to prevent redeposition and encrustation comprising the  
3 steps of:  
4           spray drying a base slurry detergent composition including a  
5 sodium polyacrylate having a molecular weight in the range of about  
6 2,000 to about 5,000 and an alkali metal carbonate;  
7           providing an agglomerated admix formulation including nonionic  
8 surfactant and about 0 to about 5 wt% of an additive; and,  
9           mixing about 50 to about 95 wt% of the base detergent  
10 composition with about 5 to about 45 wt% of the agglomerated admix  
11 formulation and about 0 to about 5 wt% of an additive to produce a  
12 granular detergent.

1           15. A low density laundry detergent composition having  
2 improved anti-redeposition properties comprising:  
3           about 5 to about 95 wt% of a spray dried base detergent including  
4 an alkali metal salt of polyacrylic acid, polymethacrylic acid or a  
5 copolymer thereof having a molecular weight in the range of 2000 to  
6 4500 and an alkali metal carbonate; and,  
7           about 5 to about 45 wt% of an agglomerated admix formulation  
8 including a nonionic surfactant.

16. The detergent composition of claim 15 wherein the base  
detergent further includes an anionic surfactant selected from the group  
consisting of an alkyl sulfonate, an alkylaryl sulfonate, an alkenyl  
sulfonate, an alkyl ethoxysulfate or an alkylene ethoxysulfate.

17. The detergent composition of claim 16 wherein the base detergent further includes an inert diluent selected from the group consisting of sodium chloride, sodium sulfate and mixtures thereof.

18. The detergent composition of claim 15 wherein the polymer is present in an amount from about 0.29 to about 5.0 wt.% of the detergent.

19. The detergent composition of claim 18 wherein the polymer has a molecular weight of about 2000-3000.

20. A laundry detergent composition having improved properties comprising:  
a spray dried slurry including about 0.59 to 5 wt% of a sodium polyacrylate having a molecular weight in the range of about 2,000 to about 5,000;  
an agglomerated admix formulation including a nonionic surfactant; and  
an effective reducing amount of an acid scavenger.

21. The composition of claim 20 wherein the sodium polyacrylate is a salt of polyacrylic acid, polymethacrylic acid, a copolymer of polyacrylic and polymethacrylic acid, or mixtures thereof.

22. The composition of claim 20 comprising about 0.59 to 1.25 wt% of the sodium polyacrylate.

23. The composition of claim 20 comprising less than or equal to 2.0 wt% of the polyacrylate.

24. The composition of claim 20 wherein the sodium polyacrylate has a molecular weight of 2000 to 4500.

25. The composition of claim 24 wherein the sodium polyacrylate has a molecular weight of 2000 to 3000.

26. The composition of claim 20 wherein the spray dried slurry comprises a builder, a anionic surfactant, an inert diluent and the sodium polyacrylate.

1           27. The composition of claim 26 wherein the builder is an alkali  
2 metal carbonate; the anionic surfactant is an alkyl sulfonate, an alkylaryl  
3 sulfonate, an alkenyl sulfonate, an alkyl ethoxysulfate, an alkylene  
4 ethoxysulfate, a sodium dodecylbenzenesulfonate, or a sodium  
5 tridecylbenzenesulfonate; and the inert diluent is an alkali metal chloride,  
6 sulfate or nitrate.

28. The composition of claim 27 wherein the builder is sodium carbonate and comprises 34-41 wt% of the composition, the anionic surfactant comprises 6.25-14.8 wt% of the composition, and the inert diluent comprises 37.69-43.18 wt% of the composition.

29. The composition of claim 20 wherein the acid scavenger is sodium perborate in an amount of up to about 6.25 wt% of the composition.



1           30. The composition of claim 20 wherein the nonionic  
2 surfactant is a primary or secondary ethoxylated alcohol, a linear alcohol  
3 ethoxylate having a molecular weight of 650 to 750 or an ethoxylated  
4 alcohol having the formula  $R-O-(CH_2CH_2O)_{12}-H$  wherein the R is a linear  
5 alcohol having 12-16 carbons.

31. The composition of claim 20 wherein the agglomerated  
admix further includes a second builder.

1           32. A method of preparing a low density laundry detergent  
2 composition to prevent redeposition and encrustation comprising the  
3 steps of:  
4           spray drying a base slurry detergent composition including a  
5 sodium polyacrylate having a molecular weight in the range of about  
6 2,000 to about 5,000 and an alkali metal carbonate;  
7           providing an agglomerated admix formulation including nonionic  
8 surfactant and about 0 to about 5 wt% of an additive;  
9           providing an effective amount of a chlorine scavenger; and  
10          mixing the base detergent composition with the agglomerated  
11 admix formulation and chlorine scavenger additive to produce a granular  
12 detergent.

33. The method of claim 32 wherein the step of providing said  
chlorine scavenger comprises providing on the order of 0.59 to about  
6.25 wt.% of sodium percarbonate, sodium perborate or mixtures  
thereof.

- 1           34. A detergent composition having improved properties  
2 comprising:  
3           about 5 to about 95 wt% of a spray dried base detergent including  
4 an alkali metal salt of polyacrylic acid, polymethacrylic acid or a  
5 copolymer thereof having a molecular weight in the range of 2000 to  
6 4500 and an alkali metal carbonate;  
7           about 5 to about 45 wt% of an agglomerated admix formulation  
8 including a nonionic surfactant; and  
9           an effective amount of a chlorine scavenger.

35. The composition of claim 34 wherein said chlorine scavenger is present in an amount of up to about 6.25 wt.% and wherein said scavenger comprises sodium percarbonate, sodium perborate and mixtures thereof.

## INTERNATIONAL SEARCH REPORT

Interr al Application No  
PCT/US 96/18688

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 5 C11D17/06 C11D3/37 C11D3/10

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 92 07932 A (PROCTER & GAMBLE) 14 May 1992  see page 1, line 12 - line 13; examples III-X ---	1,2,4, 6-13, 15-18
Y	WO 91 02047 A (HENKEL KGAA) 21 February 1991  see examples; table 1 ---	1-5,12, 13, 20-25, 29-31
Y	EP 0 080 222 A (THE PROCTER & GAMBLE CO.) 1 June 1983  see claims 1,2,5,9; examples V.,VI ---	1-5,12, 13, 20-25, 29-31
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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## INTERNATIONAL SEARCH REPORT

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